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HARVESTING CORN WITH COMBINES

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The potential for using a combine to harvest corn was first established in 1951 in tests conducted at the University of Illinois. Now it has reached the point where the combine is the predominant tool for harvesting corn in Illinois. Its acceptance by farmers has been greatly accelerated by the trend toward early harvest of shelled corn. This discussion will attempt to analyze the effect of the combine on field losses and cost of operation.

Weather a Major Factor

The weather plays a major role in corn harvest. Figure 1 shows a typical field drying rate for a full-season hybrid.

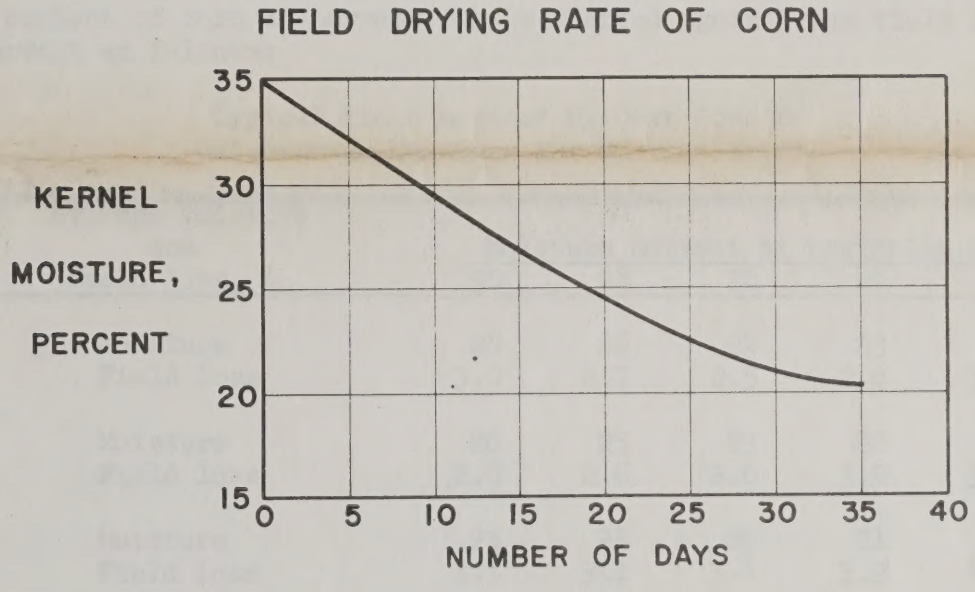


Figure 1

Weather records show that we can normally expect to lose from one-third to one-half of the total time available for harvesting. Eliminating Sundays, means that you may have as few as 14 days for harvesting corn if you start at 28 percent moisture and wish to finish by the time the moisture reaches 20 percent.

Field Loss Variation With Moisture Content

The optimum moisture content from the standpoint of field shelling is approximately 26 percent (see Figure 2). Above 26 percent you will have some difficulty in getting all of the kernels off the cob, and the tough shanks will cause some shelling in the snapping process.

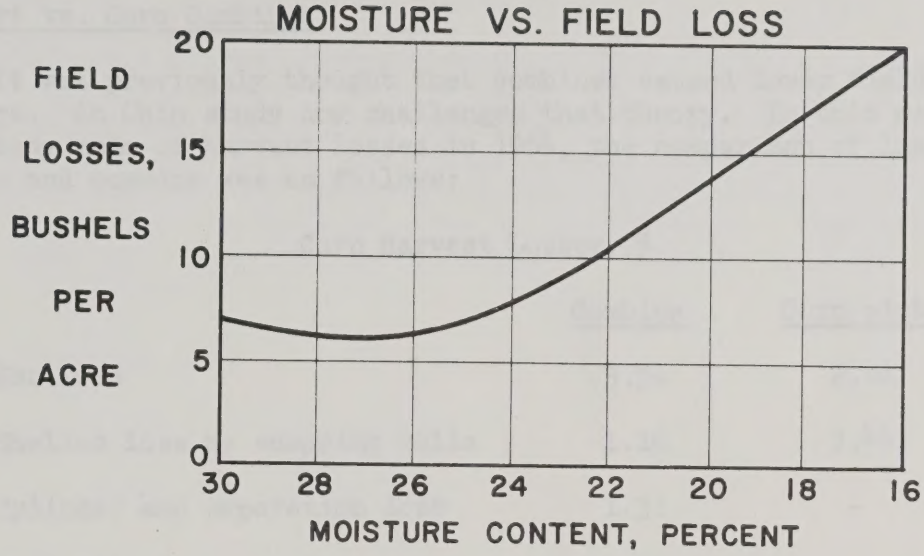


Figure 2

According to the study by Velmar Davis, USDA agricultural economist, the moisture content of corn at harvest can be charted against the field loss and length of the harvest as follows:

Typical Field Losses* by Corn Combine
and Average Moisture for Harvest Season

Length of harvest, days	Average moisture and field loss, %	Moisture content at beginning of harvest					
		30	28	26	24	22	20
8	Moisture	28	26	24	23	21	20
	Field loss	3.0	2.7	2.5	2.6	3.1	4.4
14	Moisture	26	25	23	22	21	20
	Field loss	2.8	2.6	2.6	3.0	3.5	4.9
28	Moisture	23	23	22	21	20	19
	Field loss	3.1	3.1	3.4	3.9	4.6	6.3
42	Moisture	22	22	21	20	20	19
	Field loss	3.9	4.1	4.5	5.2	5.8	8.1

*Loss figures have been adjusted from work by Velmar Davis, USDA.

There is some question about the ideal time to start harvest, but most authorities agree that harvesting with a combine is not feasible when corn contains moisture above 30 percent. Two kinds of harvest losses occur, and neither one is evident by looking on the ground. The first occurs when corn is harvested before it is mature - that is, before it has made maximum growth and yield. The second occurs as damage to the kernel. Sometimes parts of the tips are left on the cob.


MOISTURE VS. FIELD LOSS
FIELD
LOSSES, 15
BUSHELS
10
PER
ACRE
5
0
30
28
26
24
22
20
18
16
MOISTURE CONTENT, PERCENT

Corn Pickers vs. Corn Combines

It was previously thought that combines caused lower field losses than corn pickers. An Ohio study now challenges that theory. In this extensive down-the-road study made of harvest losses in 1964, the comparison of losses by the corn picker and combine was as follows:

Corn Harvest Losses, %

	Combine	Corn picker
Ear loss	3.54	2.01
Shelled loss by snapping rolls	1.16	3.44
Cylinder and separation loss	1.31	-
Invisible loss	1.46	-
Total loss	7.47	5.45

The Ohio results showed that total field loss caused by the snapping rolls was less for the corn combine than for the picker (4.70 percent versus 5.45 percent). But when cylinder, separation, and invisible losses were added, the combine had the higher total loss. In all fairness to the combine, we should point out that (1) in 1964 Ohio may have had more than an average amount of lodged corn and (2) the operators probably ran the snouts higher than normally on the combine because of stones in the field.

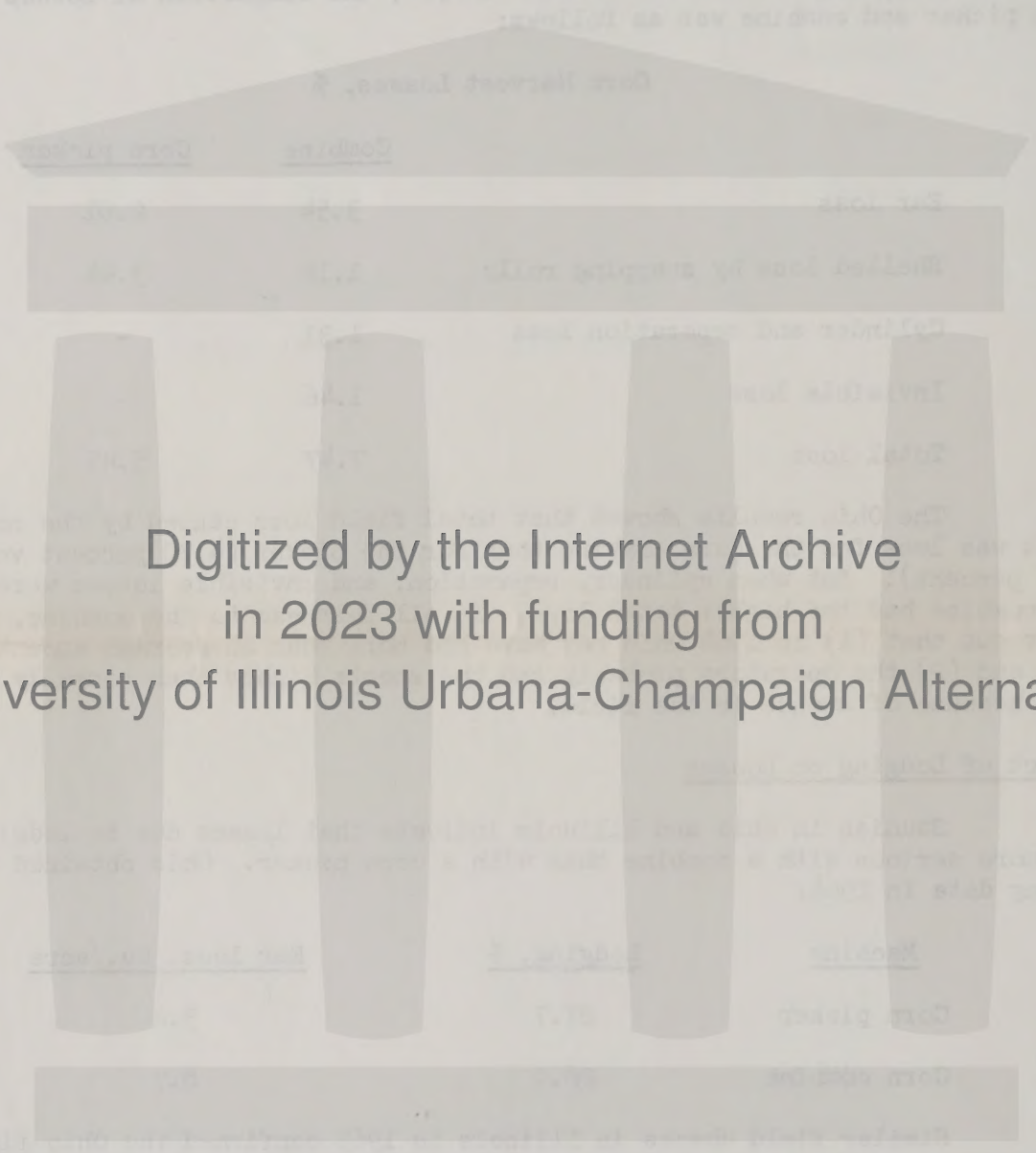
Effect of Lodging on Losses

Studies in Ohio and Illinois indicate that losses due to lodging may be far more serious with a combine than with a corn picker. Ohio obtained the following data in 1964:

Machine	Lodging, %	Ear loss, bu./acre
Corn picker	27.7	3.6
Corn combine	26.0	8.7

Similar field checks in Illinois in 1965 confirmed the Ohio findings. Under some of the most severe lodging conditions, the combine left as much as 20 bushels of ear corn per acre in the field. The design of the corn head will not permit the combine to recover ears that are down in the row.

Lodging will increase shelled corn loss only slightly for both the picker and the corn combine. Some shelling will occur when ears are caught at the lower end of the snapping rolls.



Losses in down corn can be minimized by:

1. Using a picker or picker-sheller.

2. Keeping the machine in top shape. On a corn picker, do not attempt to increase snapping roll life with a welder, as it will increase shelling loss. Replace worn rolls with new ones usually after 400 to 500 acres. They will pay for themselves in the first one-third to one-half of their new life.

3. Harvest early.

4. Keep snouts as low as possible.

5. Go slow, not over 2.5 mph.

On the basis of the Ohio data and our Illinois experiences, we would conclude that:

1. Under normal field conditions, when the moisture level is the same and when the corn is not lodged, total field losses for a combine and a corn picker will be about equal.

2. If the corn is lodged, the combine will cause higher ear losses than the picker.

Effect of Speed on Losses

For any one field condition, there is one "best" speed at which to operate the harvest equipment. If field losses are to be kept to a minimum, the normal speed range for both combines and corn pickers should be from 2.5 to 3.0 mph. Speeds in excess of 3.0 miles per hour are impractical, if for no other reason than that higher speeds limit the confidence of the operator in controlling the machine.

These data from the Ohio study emphasize the importance of speed:

Machine	Average speed, mph	Ear loss, bu./acre	Total loss, bu./acre
Corn combines	2.26	1.80	5.3
Corn combines	3.10	4.90	8.4
Corn pickers	2.25	3.25	6.9
Corn pickers	3.15	0.83	3.8

With the combine, the ear loss increased rapidly with an increase in speed. Here again the corn head was not able to recover ears on stalks that were "pushed down" ahead of the lower end of the snapping unit.

The corn picker actually had higher field losses at the slower speed. All pickers were operated at a speed of less than 2.5 mph in the slow group, causing the snapping rolls to run too fast for the ground speed. Consequently, the stalks went through the lower end of the snapping rolls and more ears were lost. A higher speed of 3.15 miles per hour pushed the stalks farther back on the rolls, saving more ears.

Effect of Row Width on Losses

No pattern seemed to develop concerning the effect of row spacing on field losses. We know that losses will increase as corn becomes lodged, but observations made in 1965 did not indicate any particular correlation between row spacing and lodging. Therefore, we think it is reasonable to assume that going to 30-inch row spacing will not increase lodging (and hence increase field losses) if a sound management program is followed in regard to fertility, population, variety, etc.

Of greater importance is the need to accurately match the row spacing of planting and harvesting units. If a 6-row, 30-inch planter is used, then a 3- or 6-row, 30-inch harvesting unit must be used.

With corn pickers, the rule of thumb is not to offset any single row of the picker more than one inch from the row being harvested. A 2-row, 40-inch corn picker could be used to harvest 38-, 40-, or 42-inch rows, but corn heads present a different problem. They have snapper bars or snapper plates that have 1 inch to 1 1/2 inches of clearance. If the stalks do not come directly into the center of the snapper plates, there is a chance that the stalk will be pushed down before the ear can be removed. Therefore, we recommend that harvesting units exactly match the row spacing of the planted rows.

Cost of Harvesting With Combines

The following table gives approximate per acre costs for harvesting with corn combines. Labor cost is not included.

Cost per Acre

Combine cost	Acres per year						
	100	200	300	400	500	600	800
$ 7,000	10.03	6.35	5.99	5.30	5.16		
8,000	11.39	7.19	6.78	5.98	5.83		
9,000	12.75	8.03	7.56	6.67	6.49		
10,000	14.11	8.86	8.35	7.35	7.16		
12,000		8.92		6.55		6.07	5.63
14,000		10.32		7.56		6.99	6.49
16,000		11.72		8.57		7.93	7.35
18,000		13.13		9.58		8.85	8.20

The following table provides a guide for estimating the capacity in acres per hour for various sizes of harvesting equipment. A reasonable amount of time is allowed for servicing equipment, turning, breakdowns, etc.

Harvest Capacity, Acres per Hour

	Size of machine				
Speed, mph	2-40"	3-30"	4-30"	4-40"	6-30"
2.25	1.34	1.49	1.90	2.42	2.62
2.50	1.45	1.61	2.06	2.63	2.82
2.75	1.55	1.73	2.21	2.80	3.00
3.00	1.65	1.83	2.33	2.96	3.16
3.25	1.73	1.92	2.45	3.10	3.25

WB:ti
12/16/65

2.5% BS of K 2/12

65-90% BS of Ca 1 ed.

Mg. 60?